Science Panel Coordination Meeting

ATTENDEES:	Bill Moellmer	Anne Fairbrother
	Theron Miller	Harry Ohlendorf
	Don Hayes	Gary Santolo
	Bill Adams	Jeff DenBleyker
	Theresa Presser	Bill Wuerthele (Wed only)
	Joe Skorupa	Earl Byron (Wed only)
OTHER ATTENDEES:	Chris Montague	Ying-Ying Macauley
	Maunsel Pearce	Bruce Waddell
	Lynn de Freitas	Nathan Darnall
	Doug Bacon	Mark Atencio
	Leland Myers	Kelly Payne
	Jill Houston	
FROM:	CH2M HILL	
DATE:	August 1, 2007	

The following summary is based on the author's notes and recollections of the discussion, and may include details that have not yet been verified. This summary is subject to review and comment by the attendees listed above. Summary will be discussed and approved during the September 6, 2007 Science Panel conference call. Please do not distribute to a wider audience until the summary is approved by the Science Panel.

Tuesday, July 31, 2007

Objective: Define Bird Diet and Egg Concentrations for Use in Evaluation

Jeff DenBleyker reviewed the status of the Threshold Values technical memorandum prepared by Harry Ohlendorf in February and outlined the outstanding items of discussion, i.e., hormesis effect, hockey stick regression, and level of protection. Jeff suggested, per the draft agenda circulated to the Science Panel, that the Panel define which ECxs would be appropriate for consideration and what concentration should be used for the ECx identified for both bird diet and bird egg thresholds. These values could then be used in developing and evaluating the conceptual model.

Discussion revolved around whether values should be defined further at this time. Bill Adams pointed out that the Panel had already defined a range of values included in Harry's memorandum. He suggested that both hormesis and hockey stick analyses should be viewed as informational, rather than influencing the threshold values that are selected. It will be too difficult for the group to define an ECx for each endpoint at this time. The Panel agreed that the range defined by the EC_{10} for both bird diet and bird eggs will be used.

CH2M HILL should use the upper and lower 95% confidence interval values (UCL and LCL, respectively) as well as the EC_{10} for each endpoint. It was agreed that communication of what these values mean will be critical. Other values within that range may still be evaluated.

Joe Skorupa asked whether the Water Quality Board could define the state's philosophy for protectiveness at this point. It was pointed out that it is difficult for a policymaker to make decisions without information that allows him/her to understand the ramifications of any decision. Others pointed out that ideally one would keep policymaking unbiased, thus would identify philosophy now before the science was defined. However, does that then bias the science? It was agreed that the Steering Committee and Water Quality Board should continue to consider the level of protectiveness while the Science Panel and project team proceed with developing the science.

Hormesis Effect

Joe Skorupa gave a presentation summarizing the hormesis effect and presented proposed adjustments to Ohlendorf's curve published in 2003. Discussion revolved around how a control is defined, the power of the statistics, and if/how the adjustments should be used.

- Joe agreed to look at his files to identify which data point(s) in the graph were excluded because of control response and why. Are they statistically important?
- It was agreed that selenium is a hormetic chemical fitting the "low-dose deficiency" pattern, and therefore it makes sense to be prudent in what numbers are used from studies.
- It was pointed out that all studies have some experimental deficiencies; however, the mallard studies used by Harry, Bill Adams, and Joe Skorupa provide the best information we have to work with. It is prudent to incorporate some level of conservatism in selecting final values.
- Not everyone was convinced that adjustments should be made due to one data point that isn't statistically very relevant.
- It was pointed out that the EPA does not include hormesis as part of its evaluations.
- It was agreed that we may not know how to adjust the data but the apparent effect should be considered.
- It was agreed that Joe's adjusted values fall within the range previously identified and help substantiate the lower end of the range.

Hockey Stick Regression

Bill Adams presented his recent evaluation of the dataset via hockey stick regression. He had been asked in the March Science Panel meeting to run the regression again with the complete dataset. It was pointed out that hockey stick is just another way of looking at the data. The ECxs from this method are conditional upon the inflection point which can be used as a surrogate for a no-effect concentration (NEC). Bill's information adds confidence to our confidence interval and NEC. It was agreed that no adjustment would be made to Ohlendorf's curves based on this analysis but, like the evaluation of hormesis, it will provide supporting information for use of the log-logistic regression (including the confidence intervals on the estimated effect level).

The data reported for the egg endpoint are as follows:

TABLE 1

	Inflection Point	LCL	EC10	UCL
Data adjusted for control	9.8	9.7	11.5	13.6
Data not adjusted for control	6.7			

EC10, LCL and UCL for data without adjustment for control not calculated due to varying confidence interval. All values are mg/kg Se dw.

The data reported for the bird diet endpoint are as follows:

TABLE 2

	Inflection Point	LCL	EC10	UCL
Data adjusted for control	3.9	3.8	4.4	4.8
Data not adjusted for control	3.2			

EC10, LCL and UCL for data without adjustment for control not calculated due to varying confidence interval. All values are mg/kg Se dw.

Conclusions

The Science Panel asked Harry Ohlendorf to prepare a brief write-up defining terminology, the values considered from the hormesis adjustment and hockey stick regression, and what they mean. The Panel agreed that CH2M HILL should proceed with three values for each endpoint defined by the LCL, EC_{10}, and UCL. Additional values within this range may be evaluated at a later point.

Review of Avian Model

Gary Santolo summarized the status and structure of the proposed model for the Panel. Limited data exist from the 2006 database. Data are not adequate to develop significant regressions to define the relationships between trophic levels. Gary is currently using simple ratios and will reevaluate when the 2007 data become available. A few suggestions were made to improve the model's accuracy, including one calculation within the model and inclusion of sediment into the diet.

Key variables that will need to be evaluated further include:

1. Composition of bird diet. How should diets be weighted?
2. What diet results should be used for model calculations (i.e., open water brine shrimp Se concentrations or site-specific brine shrimp Se concentrations)?
3. How to consider spatial and temporal variation of diet?

Wednesday, August 1, 2007

Objective: Wrap Up Threshold Values Discussion and Data Integration

Wrap-up Discussion of Threshold Values

Bill Moellmer summarized the previous day's discussion. The Science Panel agreed with the conclusions stated above in this summary.

Some additional points of agreement:

1. The lower confidence interval of the log-logistic regression approximates the NEC.
2. We are building a weight of evidence for the range we have identified, i.e., the hockey stick regression corroborates the LCL.
3. There is variability in the dataset, so it is prudent to be conservative. Some of the variability in the studies include:
    - What was required by the study
    - Control concentration in the diet, variability in the diet
    - Various issues in how the studies were completed
4. The dataset used in Ohlendorf's curves are from a species that is generally recognized as being more sensitive for reproductive effects (the main focus of the evaluation and standard for GSL) than what we are looking at on the GSL; therefore we are building in conservatism.
5. There is a difference between predictive vs. protective. We are being protective.
6. We are "data rich" in establishing an EC_{10}. Much of the literature and many regulations are based upon EC_{10}.
7. Harry Ohlendorf's write-up will be essential in communicating these concepts to the Steering Committee, Water Quality Board, and general public.
8. Joe Skorupa suggested an alternative means of communicating the threshold values that de-emphasizes the ECx terminology. Harry was asked to incorporate the data in Table 3 into his write-up. As shown in Table 3, the range of concentrations for bird diet is 3.6 – 5.7 ppm, range of 95% effects is < 1% - 32% and the range of maximum likelihood is 3% - 18.5%. The range of concentrations for bird eggs is 6.4 – 16.5 ppm, range of 95% effects is < 1% - 37.5% and the range of maximum likelihood is 1.5% - 21%.

TABLE 3
Range of Values for Use in Evaluation

Concentration	95% Effects	Maximum Likelihood
	Diet	
3.6 ppm	< 1% - 10%	3%
4.9 ppm	4% - 24%	10%
5.7 ppm	10% - 32%	18.5%
	Egg	
6.4 ppm	< 1% - 10%	1.5%
12.5 ppm	3.5% - 26.5%	10%
16.5 ppm	10% - 37.5%	21%

Review of Hailstone Sampling

Joe Skorupa reported on the Hailstone National Wildlife Refuge sampling. They collected water, sediment, brine shrimp, and 7 American avocets: 2 females with known eggs; 1 other female; and 4 males. They collected blood, liver, and eggs. They did not find food in the gut of the birds so don't have diet results. Samples should have been sent to the lab the week of July 30.

Discussion of Brine Shrimp Kinetics Study

Science Panel asked that Dr. Grosell obtain independent verification of total Se in his stock solution. They also asked that he incorporate a water concentration of 1 ug/L into his workplan.

Review of Abiotic and Invertebrate Model

Earl Byron summarized the status and structure of the proposed model to the Panel. Discussion focused upon the following:

- Preliminary transfer factors in the model are based upon 2006 data. Earl will incorporate 2007 data when available.
- It is important to develop appropriate relationships between trophic levels. Ratios will need to be used where data are not adequate for a regression. Use medians at first, along with variability (25^{th} and 75^{th} percentile) secondarily. Levels of uncertainty will need to be defined for each factor. Present summary statistics for all the data sets to the degree they are used.

- We are assuming a linear relationship between trophic levels even though it probably is not true. This is the best that can be done given the limited data set and narrow range of variability in the GSL system.

Avian Model Summary

Gary Santolo presented results of changes to the model suggested on the previous day using diets from the various locations for shorebirds and adding sediment to the diets. Once again dividing the lake into separate subsections for modeling was discussed, but the issue was not resolved. Fyrther analyses of the data will help determine what is appropriate.

Model Validation

It was agreed that the model would need to be validated but that this will be difficult given the relatively short data record. One approach may be to utilize outside data sources from GSL (i.e., Kennecott water data 2002-2005 – contact is Bill Adams, USFWS data (miscellaneous media/dates) – contact is Nathan Darnall). Long-term monitoring will be needed to provide for further validation and model updates.

Proposed Schedule Changes

Receive remaining data and draft/final reports.....August 30

Science Panel conference call.....September 6

Steering Committee meeting.....September 11

Science Panel conference call.....October 11

CH2M HILL to submit draft report and model to Science Panel.....November 1

Science Panel conference call.....November 8

Science Panel meeting in SLC.....November 28-30
Discuss draft report/model, identify refinements

Joint Science Panel/Steering Committee meeting.....November 30

CH2M HILL to submit final draft report and model to Science Panel .....January 4

Science Panel meeting in SLC.....February 20-22
Approve final report/model, define final recommendations

Joint Science Panel/Steering Committee meeting.....February 22
Discuss final recommendations

Miscellaneous To-do Items

- Look at regression of brine shrimp concentrations vs. dry weight of brine shrimp samples
- Identify different "zones" or "areas" of lake to evaluate to look for spatial variability
- Although no decision was reached on dividing the lake into separate zones or areas for the model, the final model will be configured for time periods of less than one year.